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Alberta
MUNICIPAL AFFAIRS
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COST STUDY OF SPRINKLER INSTALLATIONS FOR SENIOR CITIZENS' HOUSING

September 1991

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The views and conclusions expressed and the recommendations made in this report are entirely those of the authors and should not be construed as expressing the opinions of Alberta Municipal Affairs.

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FOREWORD

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EXECUTIVE SUMMARY

Background And Objective

Individuals and agencies within the construction, regulatory and fire-safety industries are engaged in a debate regarding the appropriateness of using fast-acting residential fire sprinklers in low-rise, wood framed, multi-family buildings up to 3 storeys in height. One of the arguments presented by sprinkler advocates is that the cost of sprinklers would be offset by savings from the reduction in construction requirements permitted by sprinklered buildings by codes. However, no detailed cost analysis of this argument has been carried out. The objective of this project is to compare the cost of sprinkler installations in selected multi-unit residential buildings to the savings which would accrue from permitted reductions in construction standards.

Approach

Three types of wood-framed buildings recently built by Alberta Mortgage and Housing Corporation (AMHC) were chosen for analysis: 1) a single storey four-plex, 2) a one storey, 30 suite senior citizens lodge and 3) a three storey 33 unit senior citizen self-contained apartment.

Each structure was analyzed in terms of the requirements of the 1985 Alberta Building Code (ABC) to determine what reductions, in terms of construction materials or assemblies, would be permitted if sprinklers were installed. Because the ABC had not anticipated sprinklers being installed in such small residential buildings, only limited reductions were specified; consequently, the buildings were also analyzed in terms of what reductions were felt to be reasonable in a future code developed with sprinklers in mind. Both groups of reductions were then evaluated by the general and mechanical contractors who had been involved in the buildings' construction to determine which of the permitted and reasonable reductions were applicable and appropriate, and cost savings were estimated for each item.

In addition to these construction/material reductions, the report briefly discusses other benefits which accrue from a sprinklered design. These include greater freedom to use open spaces or skylights, the option to employ larger windows near property lines or other structures and the chance to use less conservative or flame resistant finishing materials. While no monetary value can be ascribed to these intangibles, they do represent benefits.

Concurrent with the pricing of reductions, the associated mechanical contractors priced NFPA-13R standard sprinklers systems for each building.

Findings

The following cost estimates were produced for each of the buildings:

Building	Construction Savings	Sprinkler Costs	Net Savings (Costs)
Four-plex	$ 3,961.00	($10,000.00)	($ 6,039.00)
Lodge	$18,875.00	($61,028.00)	($42,153.00)
Walk-up Apartment	$26,016.00	($58,760.00)	($32,744.00)

Because of the apparent high cost of the sprinkler systems, particularly in the four-plex, a third independent mechanical contractor was engaged to review both the design of the three systems and their pricing. It was noted that one of the basic reasons for the high price was the cost of the fast-acting heads required in residential systems and the cost of the controls and alarms which were common to all non-single family systems.

Conclusions

In all three instances, the cost of sprinkler systems greatly exceeded the savings which might be realized from permitted reductions in construction materials or systems. While it is recognized that different designs can benefit to differing degrees, the scale of the sprinkler upcharges is so great, as to suggest that no sprinkler system can be justified in terms of cost savings.

1.0 INTRODUCTION

The Alberta Building Code (ABC) permits the reduction or replacement of fire separations and fire resistant materials in some types of residential buildings when approved sprinkler systems are installed as a fire protection system. Some suggestions have been made that the cost of sprinkler systems would be offset by these permitted reductions or replacements but this issue has not been investigated.

The purpose of this project was to ascertain whether changes in construction technologies, materials and design permitted under the 1985 ABC where sprinkler systems are installed in selected senior citizen residences result in cost reductions which can offset the cost of the sprinkler systems. The project analyzed three types of recently completed senior citizens projects provided by Alberta Mortgage and Housing Corporation (AMHC): a four-plex, a lodge and a self-contained apartment. Based on the analysis of results, the project also made conclusions about the cost effectiveness of sprinklers in typical 3 storey apartment buildings produced by the private sector of the housing industry.

The remainder of this report is presented in the following sections:

Section 2 describes the buildings analyzed and the costing analysis that was carried out.

Section 3 presents the detailed results of the analysis in terms of the permitted differences in sprinklered and unsprinklered buildings for the three buildings analyzed in this study.

Section 4 draws conclusions.

Appendices: The three Appendices contain the following information:

a) technical drawings of the three buildings analyzed in this study,
b) design drawings for the sprinkler systems for each building, and
c) specifications for the sprinkler systems.

2.0 APPROACH

2.1 Selected Buildings

Three recently completed senior citizen's apartments were selected for study from Alberta Mortgage and Housing Corporation's (AMHC) portfolio. Plans for the three buildings can be found in Appendix A.

Four-plex

This is a four unit, single storey senior's apartment which includes a lounge and public washrooms, and encompasses an area of some 296 sq.m. The project was designed and constructed by AMHC in 1988 and was classified as a Part 9 Group C structure with a crawl space, non-sprinklered and facing two streets.

Lodge

This structure is a seniors' lodge encompassing some 1500 sq.m. Designed by the Gibbs Gage Partnership, the facility was built in 1989. In addition to its 26 conventional and four barrier-free suites, the building contains a lounge, crafts and games areas, commercial kitchen and dining room, laundry, tenant storage, and a manager's office. The lodge is a single storey building with crawl space, but with a basement mechanical room; non-sprinklered and facing two streets, the facility is classified as Part 3, Group C (Alberta Building Code (ABC) Article 3.2.2.27).

Self-Contained Apartment

Encompassing 2329 sq.m. on three floors, this 33 unit seniors' self-contained apartment complex was designed by the Bill Boucock Partnership and built in 1989. Along with 31 standard units and 2 barrier-free units, the complex encompasses a lounge, crafts and laundry area. Classified as a Part 3 Group C structure (ABC Article 3.2.2.27), the building is non-sprinklered and faces three streets.

2.2 Code Analysis

The Alberta Building Code recognizes that a building with a sprinkler system is safer than one without; consequently, in those instances where sprinklers are used, it allows for reductions in some of the fire safety construction standards. For example, use of sprinklers allows increased open areas, the reduction or elimination of fire separations, and the deletion of fire-rated doors.

The Alberta Building Code was reviewed to identify and list the full range of potential construction changes that would be permitted in each of the three buildings if they were sprinklered. The items on each list were then evaluated to determine which of the permitted changes were both applicable and appropriate for each building, and each of these were in turn costed.

One problem with this approach is that neither the construction industry nor the building officials had contemplated sprinklers being installed in the small residential buildings under consideration; consequently, the Code does not contain the same range of reductions for the building classification applicable to the small buildings analyzed as it permits in some of similar construction and use but classified differently. To respond to this situation and give the sprinkler option the maximum potential benefit, the researchers drew upon their engineering knowledge and judgement to identify a number of further reductions than those explicitly permitted. These are considered as reasonable extensions of existing code and were reviewed with officials from Alberta Labour before inclusion in the analysis. Both the prescribed and reasonable reductions are listed in the tables presented for each of the three buildings.

Naturally, some potential reductions such as the fire rating of garbage chutes or group tenant storage rooms were not applicable to all buildings and have been omitted. One exception existed in the four-unit apartment building, where implementation of the potential reduction would have been more expensive than the existing higher construction standard and it was therefore omitted. This unusual situation was an attribute of the building's small size and would not apply to a larger structure.

2.3 Sprinkler System Designs

Concurrent with the identification and selection of reduced requirements, complete sprinkler systems were designed for each building. The designs followed normal engineering practice and conformed to NFPA-13R, "Standard for the Installation of Sprinkler Systems in Residential Occupancies". Drawings and specifications for the three designs can be found in Appendices B and C.

2.4 Costing

Costing of the construction changes was done by the general contractors who had built the lodge and apartment building. Each was engaged to do quantity take-offs and costing of their own building as well as provide input on the costing of the small fourplex. Similarly, the mechanical contractors involved in the lodge and apartment were engaged to cost the mechanical changes and to prepare a lump-sum tender price for the supply and installation of the sprinkler systems as designed and specified in Appendices B and C respectively for their own building. They also reviewed and costed sprinklering the four-plex.

3.0 ANALYSIS

3.1 Detailed Results

The information gathered from the above work on the individual buildings is presented in the following three tables. The items are numbered consecutively and grouped under general headings for convenience. Relevant Code sections (from the 1985 ABC) are referenced in the same column ("Item and Code References"). This is followed by a column which paraphrases the Code requirements for non-sprinklered buildings (see "Non-Sprinklered Building Requirements"). The next column ("Summary of Permitted Relaxations in Sprinklered Buildings") contains a brief discussion of the applicability of the proposed reduction in a generic situation. The next column ("Permitted Changes Adopted") identifies where the reduction has been applied. The final column ("Savings") specifies the cost saving that would arise from the proposed change in construction.

TABLE 1

ANALYSIS OF POTENTIAL CONSTRUCTION VARIANCES AND THE RESULTANT COST IMPLICATIONS ARISING FROM THE USE OF SPRINKLERS IN PART 9 BUILDINGS AS APPLIED TO A FOUR-PLEX FOR SENIORS

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED[1] CHANGES ADOPTED	SAVINGS
1	Fire Compartments				
	9.10.15.7	Concealed spaces above ceilings such as roof spaces or attics must be compartmentalized into areas not exceeding 300 sq. m.	The requirement for compartments is waived.		
2	Flame-Spread Ratings				
	9.10.16.4 9.10.16.7	Wall and ceiling finishes in public exits and restricted corridors have flame-spread ratings.	These limits on flame-spread are waived.		
3	Roof Construction				
	9.10.8.1	No rating required.			

1 Not all relaxations permitted by the code resulted in changes being proposed for the specific Type 1 building being analyzed. Where changes are proposed, they are specified and an appropriate cost benefit assigned to them.

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
4	Exposure Protection				
	9.10.14.1	The maximum allowable size of unprotected openings such as windows in an exterior wall is restricted generally on the basis of distance to a defined line such as the property line.	The area of unprotected openings is doubled.		
5	9.10.14.15	Restricts the distance between unprotected openings such as windows where adjacent walls meet at an angle.	This restriction is waived.		
6	Fire Fighter's Access				
	9.10.19.1	Requires an access panel for fire fighting on the second and third storey of every building.	This requirement is waived.		
7	Barrier Free Access 9.9.2.7 3.3.1.5.(1)	Requires barrier free access to floors above the first floor level.	This requirement is waived.		
8	Building Construction				
	9.10.5.3	Fire stop flaps are required to protect openings in ceiling membranes requiring a fire resistance rating.	This requirement is eliminated when membrane rating requirement is waived due to sprinklering.		

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
9	Building Construction Cont.				
	9.10.9.21	Public corridors, walls and ceilings, are required to be separated from the remainder of the building by a rated fire separation.	Article 9.10.9.22 of the Code permits the use of non-rated corridor separations in non-residential sprinklered buildings. If that approach is applied to this building, it would appear reasonable to permit the downgrading of walls to non-rated assemblies. Further, it would then be reasonable to use non-rated door frames and hollow core doors (see points #16 and 17).	At both sides of corridor walls, change gypsum board from 15.9 mm fire rated to 12.5 mm standard. (30 min. fire rating to none)	$ 78.00
10	9.10.10.3	A one-hour fire separation is required between service rooms containing specified building service equipment and adjoining spaces.	This requirement is relaxed except for rooms containing fuel-fired equipment.	At service room partitions, change 15.9 mm fire-rated gypsum board to 12.5 mm fire rated gypsum board. (60. min. to 45 min.)	$ 12.00
11	9.10.10.11	A one-hour fire separation is required for rooms used for storage of combustible refuse.	Required rating is reduced to 45 minutes.	Change service room ceiling from 2 layers of 15.9 mm fire-rated gypsum board to one layer. (60 minutes to 45 minutes)	$ 5.00

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
12	Building Construction Cont.				
	9.10.13.15	Fire dampers are required where ducts penetrate a required fire-rated separation such as walls, ceilings and floors.	This requirement is eliminated when the separation requirement is waived due to sprinklering.	Delete fire dampers at all separations changed to non-rated as per items 9 and 16.	$500.00
13	Travel Distance				
	9.9.8.4	Maximum distance to an exit is 30 meters.	Maximum distance to an exit is increased to 45 meters.		
14	Fire Detectors				
	9.10.17.5	Heat detectors are required in specific areas of buildings required to have a fire alarm system.	The requirement for heat detectors is waived by ensuing Article 9.10.17.6.	Delete all heat detectors.	$750.00

The following proposed reductions or changes in construction standards are not currently permitted by the Alberta Building Code in response to the sprinklering of a building. However, based on a combination of the precedents of other permitted reductions, sound engineering judgement, and discussions with Alberta Labour, the following proposals represent reasonable reductions and are included here to identify the greatest potential benefits which might accrue if sprinklers were more liberally utilized in multi-unit, low-rise residential construction.

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
15	Building Construction				
	9.10.9	Requires rated separations between defined major occupancies.	Subsections 9.10.9 outlines the separations required between major occupancies. These regulations are applied regardless of sprinklering; however a reduction in rating of these fire separations might be a reasonable change.		
16	9.10.9.14	Requires a rated ceiling membrane between vertical fire separations and concealed spaces above.	Article 9.10.9.14 requires a rated ceiling membrane between vertical fire separations where there is a continuous concealed space above, such as an attic. This requirement can reasonably be deleted due to sprinklering the building: consequently, standard gypsum board could be used instead of that required by a 30-minute rating.	At all ceilings, change gypsum board from 15.9 mm fire rated to 12.5 mm standard. (30 min. to none) at service room ceiling, change two layers of 15.9 mm fire rated gypsum board to one layer. (60 min. to 45 min.)	$218.00

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
17	Building Construction Cont.				
	9.10.12.6	Suites with a common roof require overhanging soffits to be of non-combustible material.	Article 9.10.12.6 requires improved soffit protection where windows occur below an attic or continuous roof space. Cost savings could accrue if, with sprinklering, the Code allowed the reasonable reduction to standard residential perforated aluminium soffits.	Change soffit from .39 mm thick steel to perforated aluminium.	No change.
18	9.10.13.2	Doors between a public corridor and a suite require a 20 minute fire protection rating.	This requirement is reduced due to sprinklering. The implication is that the door is changed to a non-rated door as was done elsewhere in this study.	Change corridor and mechanical room doors (total 7) to non-rated hollow core oak veneer from 20 minute solid prefinished legacy golden oak veneer (45 min. to non-rated).	$280.00
19	9.10.13.3	Doors requiring a 20 minute fire protection rating must be mounted in a tested and rated frame.	This requirement is reduced with the implication that a non-rated frame is now acceptable as the door is also unrated.	Change corridor door frame from rated wrap-around wood veneered (4) and pressed steel (3) to solid red-oak rabbetted, complete with oak casings.	$255.00

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
20	Building Construction Cont.				
	9.10.13.11	All doors installed in a rated fire separation require a self-closing device.	Under clause 3.1.6.8 of the Code, door closures are required at separations, but are waived for corridors in some building types. Residential occupancies are excluded as residents may neglect to close their door while escaping a fire. The use of spring hinges or rising butt hinges or total removal of the requirement would counteract this problem and result in cost savings.	Delete corridor and mechanical room door closers. Change hinges from 1 1/2 hr. ball bearing butts to 1 1/2 hr. rated spring type butts.	$463.00
21	9.1.1.1	The maximum building area allowed under this classification is 600 sq.m.	No relaxation under current code; however, it would appear reasonable to allow area to be doubled as in other types of buildings thus eliminating the need for firewall separations in buildings under 1200 sq. m.		

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
22	Building Construction Cont.				
	Plumbing				
	9.10.9.26	Combustible piping is not to be used in drain or waste systems penetrating a required fire separation.	Due to the proposed elimination of fire separations, (see item #10), the deletion of the restricted use of combustible pipe would seem reasonable.	Change plumbing drainage to ABS.	$1,400.00

Total Potential Savings (items 1-22 inclusive)	$ 3,961.00
Install sprinkler systems as per specifications.	($10,000.00)
TOTAL Savings (cost)	**($ 6,039.00)**

TABLE 2

ANALYSIS OF POTENTIAL CONSTRUCTION VARIANCES AND THE RESULTANT COST IMPLICATIONS ARISING FROM THE USE OF SPRINKLERS IN PART 3 BUILDINGS AS APPLIED TO A SENIOR CITIZEN'S LODGE

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
23	Fire Compartments				
	3.1.6.4.(6) 3.1.6.4.(7)	The maximum allowable size of opening in a fire separation protected by a closure such as a door is limited to 11 sq. m.	The maximum allowable size of protected opening is increased to 22 sq. m.		
24	3.1.9.3.(1)	Concealed spaces within a ceiling or roof assembly must be separated into compartments not exceeding 600 sq. m.	Separations not required if the space is sprinklered.		
25	3.2.1.5.(1)	Basements must be separated into compartments not exceeding 600 sq. m.	Separations not required if basement is sprinklered.	Delete crawlspace separations including partitions and doors.	$1,501.00
26	Flame-Spread Ratings				
	3.1.11.5	Wall and ceiling finishes in public exits and corridors have restricted flame-spread ratings.	These restrictions are waived.		
27	3.1.11.7	Non-combustible construction such as heavy timber is not permitted in public exits	This restriction is waived allowing the use of wood or timber construction.		

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
28	Roof Construction				
	3.2.2.8.(1)	Roof construction must have fire-resistance rating as per subsection 3.2.2.	These ratings are waived.		
29	3.2.2.8.(2)	Roof must have a fire-resistance rating or be of non-combustible construction.	Heavy timber roof construction is permitted up to 2 storeys.		
30	Size and Occupancy Classification				
	3.2.2.27	The maximum allowable building footprint areas for non-sprinklered buildings is set out depending on the number of storeys and the number of adjoining streets. For each classification type, fire-resistance and separations are established.	The allowable area in each classification is doubled and the number of access streets reduced.	Delete gravelled access street from maintenance storage building south to asphalt at kitchen receiving lane. Replace with topsoil and sod.	$400.00
31	Exposure Protection				
	3.2.3.8.(1) 3.2.3.1.(1) 3.2.3.5.(1)	The maximum allowable size of unprotected openings such as windows in an exterior wall is restricted based generally on the distance to a defined line such as the property line and based on wall construction criteria.	The allowed area of unprotected openings such as windows is doubled.		
32	3.2.3.10.(1)	Restricts the distance between unprotected openings where adjacent walls meet at an angle.	This restriction is waived.		

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
33	3.2.3.11.(1)	Skylights must be located 5 m from walls with windows exposed to the roof.	This restriction is waived.		
34	Fire Fighter's Access				
	3.2.5.1.(1) 3.2.5.1.(5)	Requires access for fire fighting on all floor levels less than 25 m above grade.	This requirement is waived.		
35	Height and Volume				
	3.2.5.5.(6)	Building height and volume of fire compartments are assigned maximums. (eg. Floors must be under 8 m above grade.)	Maximums are waived for this item.		
36	3.1.6.8.(1) 3.1.6.8.(2)	Doors located in a fire separation require automatic closing devices.	This requirement is waived by elimination of fire separation by sprinklering.	Remove occupancy separation (60 min.) at beauty parlor. Door to be non-rated hollow core with oak frame and spring hinges. Drywall to be standard 12.5mm type.	$80.00
37	Barrier Free Access				
	3.3.1.5.(1)	On upper floors, provisions are required to provide disabled occupants additional time to escape.	These measures are waived.		

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
38	Building Amenities				
	3.3.4.2.(3)	Storage rooms not contained within the suites are not permitted.	Group tenant storage rooms are permitted.		
39	3.4.4.1.(7) (iii)	A rated fire separation is required between a lobby and adjacent space.	This requirements is waived.	At corridor and lobby partitions (except stair, janitor's rooms and beauty salon), change gypsum board on both sides from 15.9 mm fire-rated to 12.5 mm standard.	$375.00
40	3.5.2.4.(1)	One hour fire separation is required between adjacent spaces and service rooms containing equipment.	This requirement is waived.		
41	3.5.3.2.(6)	Linen or refuse chutes not permitted if not sprinklered.	Chutes are permitted.		
42	Travel Distance				
	3.4.2.4.(1)	The maximum allowable travel distance to an exit is limited to 30 m.	The allowable distance is extended to 45 m.		

The following proposed reductions or changes in construction standards are not currently permitted by the Alberta Building Code in response to the sprinklering of a building. However, based on a combination of the precedents of other permitted reductions, sound engineering judgement, and discussions with Alberta Labour, the following proposals represent reasonable reductions and are included here to identify the greatest potential benefits which might accrue if sprinklers were utilized in multi-unit, low-rise residential construction.

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
43	Fire Separations				
	3.1.3.	Requires fire separations between defined major occupancies.	Subsection 3.1.3 outlines the separations required between major occupancies. These regulations are applied regardless of sprinklering; however, a reduction in rating of these fire separations might be a reasonable reduction in the Type 2 building which contains a main salon area. Normally this might be considered a separate major occupancy requiring a fire separation; however, given the type of occupancies and use, the reduction appears reasonable		

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
44	Fire Separations (cont.)				
	3.1.6.3.(2)	Requires a rated membrane between vertical fire separations and concealed spaces above this.	Sentence 3.1.6.3.(2) requires a rated ceiling membrane between vertical fire separations where there is a continuous concealed space above, such as an attic. This requirement can reasonably be deleted due to sprinklering the given building; consequently, standard gypsum board could be used instead of that required by a 30-minute rating.	At all ceilings (except at stairs, janitor's rooms and beauty salon) change gypsum board from 15.9 mm fire-rated to 12.5 mm standard.	$1,110.00
45	3.1.6.7	Doors located in a fire separation require a minimum of 20 minutes.	This requirement is reduced, but it would appear reasonable to change the door to non-rated as was done for this study.	Change corridor and lobby doors from 20 minute solid core flush face oak veneer to non-rated hollow core. (45 min. to non-rated separation)	$1,080.00

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
46	Fire Separations (cont.)				
	3.1.6.8.(1)	All doors located in a fire separation are required to have an automatic closing device.	Under Clause 3.1.6.8, of the Code, door closers are required at separations, but are waived for corridors in some building types. Residential occupancies are excluded as residents may neglect to close their door while escaping a fire. The use of spring hinges or rising butt hinges or total removal of the requirement would counteract this problem and result in cost savings.	Delete closers at above doors. Change hinges from 1 1/2 hour ball bearing butts to 1 1/2 hour rated spring type butts.	$1,988.00
47	3.2.3.11.(2)	Soffits overhanging more than two suites require fire-resistant construction.	Article 3.2.3.11 requires improved soffit protection where windows occur below an attic or continuous roof space. Cost savings could accrue if, with sprinklering, the Code allowed the reasonable reduction to a standard residential perforated aluminum soffits.	At soffits, delete 12.7 mm plywood.	$1,750.00

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
48	Fire Separations (cont.)				
	3.3.4.2.(1)	Suites of residential occupancy to be separated from each other and the remainder of building by a one hour rated separation.	Article 3.3.1.3 of the Code permits the use of non-rated corridor separations in non-residential sprinklered buildings. If that approach is applied to this building, it would appear reasonable to permit the downgrading of walls to non-rated assemblies. Further, it would then be reasonable to allow non-rated door frames and hollow core doors. (See points #22 and 25)		
49	Interconnected Floor Spaces				
	3.2.8.5.(1)	Interconnected floor spaces are not permitted except for some mezzanines as per 3.2.8.1.(4).	Interconnected floor spaces seem reasonable, subject to other restrictions.		
50	Standpipes				
	3.2.5.4.(1)	Standpipes required for buildings greater than 14 m in height and area greater than Table 3.2.5A.	The requirement for standpipes seems reasonable.		

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
51	Fire Dampers 3.1.6.5	Fire dampers are required where ducts penetrate fire separations.	Fire dampers not required when fire separations are eliminated due to sprinklering.	Delete fire dampers at all fire separations.	$6,000.00
52	Fire Detectors 3.2.4.10	Fire detectors are required in certain areas of building.	The requirement for heat detectors is waived. Reasonable to extend elimination to fire detectors.	Delete all fire detectors.	$600.00
53	Plumbing 3.1.7.3.(1)	Combustible piping not to be used in drain or waste system penetrating required fire separation.	Due to the proposed elimination of fire separations, see item #39, deletion of the restricted use of combustible pipe would seem reasonable.	Change plumbing drainage piping to ABS.	$3,991.00
	Total Potential Savings				
	Install sprinkler systems as per specifications				$18,875.00
	TOTAL Savings (cost)				($61,028.00)
					($42,153.00)

TABLE 3

ANALYSIS OF POTENTIAL CONSTRUCTION VARIANCES AND THE RESULTANT COST IMPLICATION ARISING FROM THE USE OF SPRINKLERS IN PART 3 BUILDINGS AS APPLIED TO A SELF-CONTAINED APARTMENT BUILDING FOR SENIORS

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
54	Fire Compartments				
	3.1.6.4.(6) 3.1.6.4.(7)	The maximum allowable size of opening in a fire separation protected by a closure such as a door is limited to 11 sq. m.	The maximum allowable size of protected opening is increased to 22 sq. m.		
55	3.1.9.3.(1)	Concealed spaces within a ceiling or roof assembly must be separated into compartments not exceeding 600 sq. m.	Separations not required if the space is sprinklered.		
56	3.2.1.5.(1)	Basements must be separated into compartments not exceeding 600 sq. m.	Separations not required if basement is sprinklered.	Delete crawlspace separations including partitions and doors.	$1,080.00
57	Flame-Spread Ratings				
	3.1.11.5	Wall and ceiling finishes in public exits and corridors have restrictive flame-spread ratings.	These restrictions are waived.		
58	3.1.11.7	Non-combustible construction such as heavy timber is not permitted in public exits	This restriction is waived allowing the use of wood or timber construction.		

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
59	Roof Construction				
	3.2.2.8.(1)	Roof construction must have fire-resistance rating as per subsection 3.2.2.	These ratings are waived.		
60	3.2.2.8.(2)	Roof must have a fire-resistance rating or be of non-combustible construction.	Heavy timber roof construction is permitted up to 2 storeys.		
61	Size and Occupancy Classification				
	3.2.2.27	The maximum allowable building footprint areas for non-sprinklered buildings is set out depending on the number of storeys and the number of adjoining streets. For each classification type, fire-resistance and separation specifications are established.	The allowable area in each classification is doubled and the number of access streets reduced.	Delete gravelled access road from maintenance storage building south to asphalt at kitchen receiving lane. Replace with topsoil and sod.	$400.00
62	Exposure Protection				
	3.2.3.8.(1) 3.2.3.1.(1) 3.2.3.5.(1)	The maximum allowable size of unprotected openings such as windows in an exterior wall is restricted based generally on the distance to a defined line such as the property line and based on wall construction criteria.	The allowed area of unprotected openings such as windows is doubled.		
63	3.2.3.10.(1)	Restricts the distance between unprotected openings where adjacent walls meet at an angle.	This restriction is waived.		

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
64	Exposure Protection (cont.)				
	3.2.3.11.(1)	Skylights must be located 5 m from walls with windows exposed to the roof.	This restriction is waived.		
65	Fire Fighter's Access				
	3.2.5.1.(1) 3.2.5.1.(5)	Requires access for fire fighting on all floor levels less than 25 m above grade.	This requirement is waived.		
66	Height and Volume				
	3.2.5.5.(6)	Building height and volume of fire compartments are assigned maximums. (eg. Floors must be under 8 m above grade.)	Maximums are waived for this item.		
67	3.1.6.8.(1) 3.1.6.8.(2)	Doors located in a fire separation require automatic closing devices.	Under Clause 3.1.6.8, of the Code, door closers are required at separations, but are waived for corridors in some building types. Residential occupancies are excluded as residents may neglect to close their door while escaping a fire. The use of spring hinges or rising butt hinges or total removal of the requirement would counteract this problem and result in cost savings.	Delete closers at above doors. change hinges from 1 1/2 hour ball bearings butts to 1 1/2 hour rated spring-type butts.	$1,978.00

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
68	Barrier Free Access				
	3.3.1.5.(1)	On upper floors, provisions are required to provide disabled occupants additional time to escape.	These measures are waived.		
69	Building Amenities				
	3.3.4.2.(3)	Storage rooms not contained within the suites are not permitted.	Group tenant storage rooms are permitted.		
70	3.4.4.1.(7) (iii)	A rated fire separation is required between a lobby and adjacent space.	This requirement is waived.	At corridor and lobby partitions (except stair, janitor's rooms and beauty salon), change gypsum board on both sides from 15.9 mm fire-rated to 12.5 mm standard.	$375.00
71	3.5.2.4.(1)	One hour fire separation is required between adjacent spaces and service rooms containing equipment.	This requirement is waived.		
72	3.5.3.2.(6)	Linen or refuse chutes not permitted if not sprinklered.	Chutes are permitted.		

The following proposed reductions or changes in construction standards are not currently permitted by the Alberta Building Code in response to the sprinklering of a building. However, based on a combination of the precedents of other permitted reductions, sound engineering judgement, and discussions with Alberta Labour, the following proposals represent reasonable reductions and are included here to identify the greatest potential benefits which might accrue if sprinklers were utilized in multi-unit, low-rise residential construction.

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
73	Fire Separations				
	3.1.3.	Requires fire separations between defined major occupancies.	Subsection 3.1.3 outlines the separations required between major occupancies. These regulations are applied regardless of sprinklering; however, a reduction in rating of this fire separation might be a reasonable reduction in the Type 2 building which contains a main salon area. Normally this might be considered a separate major occupancy requiring a fire separation; however, given the type of occupancies and use, the reduction appears reasonable.		

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
74	Fire Separations (cont.)				
	3.1.6.3.(2)	Requires a rated membrane between vertical fire separations and concealed spaces above this.	Sentence 3.1.6.3.(2) requires a rated ceiling membrane between vertical fire separations where there is a continuous concealed space above, such as an attic. This requirement can reasonably be deleted due to sprinklering the given building; consequently, standard gypsum board could be used instead of that required by a 30-minute rating.	At all third floor ceilings (except at stair and janitor's room) change gypsum board from 15.9 mm fire-rated to 12.5 mm standard.	$732.00
75	3.1.6.7	Doors located in a fire separation require a minimum of 20 minutes.	This requirement is reduced, but it would appear reasonable to change the door to non-rated as was done for other building types in this study.	Change corridor and lobby doors from 20 minute solid core flush face oak veneer to non-rated hollow core. (45 min. to non-rated separation) Change above door frames from rated pressed steel fully welded to solid red oak rabbetted, complete with oak casings.	$2,484.00

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
76	Fire Separations (cont.)				
	3.2.3.11.(2)	Soffits overhanging more than two suites require fire-resistant construction.	Article 3.2.3.11 requires improved soffit protection where windows occur below an attic or continuous roof space. Cost savings could accrue if, with sprinklering, the Code allowed the reasonable reduction to a standard residential perforated aluminum soffit.	Change non-vented .38 mm steel soffits to perforated aluminum.	$1,350.00
77	3.3.4.2.(1)	Suites of residential occupancy to be separated from each other and the remainder of building by a one hour rated separation.	Article 3.3.1.3 of the Code permits the use of non-rated corridor separations in non-residential sprinklered buildings. If that approach is applied to this building, it would appear reasonable to permit the downgrading of walls to non-rated assemblies. Further, it would then be reasonable to allow non-rated door frames and hollow core doors. (See points #22 and 25)	At corridor and lobby partitions (except at stair and janitor's room) change gypsum board on both sides from 15.9 mm fire-rated to 12.5 mm standard.	$837.00

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
78	Travel Distance				
	3.4.2.4.(1)	The maximum allowable travel distance to an exit is limited to 30 m.	Extending the allowable distance to 45 m seems reasonable.		
79	Interconnected Floor Spaces				
	3.2.8.5.(1)	Interconnected floor spaces are not permitted except for some mezzanines as per 3.2.8.1.(4).	Interconnected floor spaces seems reasonable, subject to other restrictions.		
80	Standpipes				
	3.2.5.4.(1)	Standpipes required for buildings greater than 14 m in height and area greater than Table 3.2.5A.	Waiving the requirement for standpipes seems reasonable.		
81	Fire Dampers				
	3.1.6.5	Fire dampers are required where ducts penetrate fire separations.	Fire dampers not required when fire separations are eliminated due to sprinklering.	Delete fire dampers and fire flaps at all separations.	$3,000.00
82	Fire Detectors				
	3.2.4.10	Fire detectors are required in certain areas of some buildings.	Deleting heat detectors seems reasonable.	Delete all heat detectors.	$780.00

NO.	ITEM AND CODE REFERENCE	NON-SPRINKLERED BUILDING REQUIREMENTS	SUMMARY OF PERMITTED RELAXATIONS FOR SPRINKLERED BUILDINGS	PERMITTED CHANGES ADOPTED	SAVINGS
83	Plumbing				
	3.1.7.3.(1)	Combustible piping not to be used in drain or waste system penetrating required fire separation.	Due to the proposed elimination of fire separations, (see item #39), deletion of the restricted use of combustible pipe would seem reasonable.	Change drainage piping to ABS.	$13,000.00
Total Potential Savings					$26,016.00
Install sprinkler systems as per specifications					($58,760.00)
TOTAL Savings (cost)					**($32,744.00)**

3.2 Discussion of Cost Estimates

An earlier study (Cost Study of Sprinkler Installation for Residential Housing, Wiebe Forest Engineering Ltd, October 1989) indicated that the cost of a full sprinkler system for a single family dwelling would average $\$21.80/m^2$. It was reasoned that the cost of sprinklering the four-plex structure should be in the same range, and possibly even somewhat lower since only a single head end is required to serve four dwelling units. However, the quoted unit cost for the four-plex, $\$33.78/m^2$ ($10,000 for $296m^2$), contradicts that logic. Therefore, another mechanical contractor was engaged to provide additional prices for each building. Those prices confirmed the accuracy of the original prices received.

To rationalize the sprinklering costs for the three buildings in terms of comparing them to industry norms, the following circumstances were identified through discussions with the participating mechanical contractors:

1. Each of the buildings studied in this project includes either a full crawl space or, in the case of the 3-storey apartment, a full basement that is required to be sprinklered, but is not included in the figure describing the building's area. To properly compare costs against industry norms, the building areas must reflect actual sprinklered areas.

2. The "head end" (pumps, controls, valves, gauges, fire department connections, header piping) comprises a significant portion of the sprinkler system cost. As building size increases, the head end cost becomes less significant. Industry average costs as available for comparative purposes in respect of this study generally reflect much larger buildings (for example, high rise apartments) than those considered here, so unit pricing should be expected to be somewhat higher than industry norms.

With consideration to item 1 above, the following table was derived to reflect actual unit costs for sprinklering the buildings of this study.

Table 4 - Unit Costs for Sprinkler Systems

Building	Finished Area	Sprinklered Area	Quoted Total Cost	Unit Cost
Four-plex	296m^2	592m^2	$10,000	$16.89/$m^2$
Lodge	1500m^2	3,000m^2	$61,028	$20.34/$m^2$
Apartment	2,329m^2	3,034m^2	$58,760	$19.37/$m^2$

The unit cost for the four-plex compares favourably against the previously calculated cost for a single family dwelling, considering that the head ends for the two sprinkler systems are of essentially the same scale. The industry average for sprinkler systems in apartment buildings was approximately $18.12/$m^2$ in 1989. With allowances for normal cost escalation to 1990 and possible head end cost imbalances between the subject buildings and industry norms, the unit costs for the lodge and apartment building were deemed realistic.

4.0 CONCLUSIONS

4.1 Cost Effectiveness of Sprinklering

Based on the available information, it is evident that in all three buildings analyzed, the cost of sprinklering far exceeds the cost savings which might be achieved from the changes or reductions in building design or construction which would be permitted by the Alberta Building Code because of the sprinklers. Further it is recognized that while alternate buildings might demonstrate a different set of costs, the extra cost of the sprinklers is so high on average, that it is unlikely that any conventional combination of building type and sprinkler system could be cost-effective.

For those interested in the application of this work to the broader multi-unit, low-rise, wood-framed residential building industry, it must be noted that the buildings studied, although drawn from Alberta's social housing portfolio, closely resemble numerous private sector structures which can be found throughout the Province. This is particularly true of the four-plex and three storey apartment buildings which are similar to a small scale rental housing and conventional 3 storey walk-up apartments respectively.

4.2 Other Benefits

Aside from cost considerations, sprinklering yields various non-financial benefits which might influence an owner or designer to consider sprinklering a building. Some of these are discussed below.

Design can be influenced from spatial and material perspectives when sprinklers are incorporated in a building. Sprinklering opens the way for designers to use interconnected floor spaces such as multi-storeyed atriums as noted in clause 3.2.8.5.(1). This would allow single-loaded access corridors to open into apartments of a large central garden or social space. This would greatly enhance the openness of the building and foster greater communications between residents. Sprinklers permit the use of finishing materials with higher flame-spread ratings. As noted in reference to sections 3.1.11.5, 9.10.16.4 and 9.10.16.7, these reductions would even open up the use of such materials as wood finishes. In the

same vein, designers could utilize other options including skylights (pursuant to Section clauses 3.2.3.11.(1) and 9.10.12.4 of the Code) to further open up their designs.

Relaxations in construction standards can also affect a building's exterior and siting. An example of this is the reduction in separation distance between the building and the property line because of the use of sprinklers. While this can be used to locate a larger building on a given property, the reductions permitted by Sections 3.2.3. and 9.10.14 also allow the designer greater freedom through locating a structure closer to a property line. This facilitates the aggregation of areas into more useful landscaped zones and amenity areas to the benefit of both the building users and adjacent property owners. A more subtle impact resulting from the use of sprinklers is the relaxation of limits on window openings. With sprinklering, the designer is able to enlarge and in some cases include windows in walls to create a more pleasant facade.

The final benefit deals with user safety. Although the Code classifies senior's residences in the general residential use category, group C, many seniors face problems of mobility during an emergency, because of their infirmity or reduced mobility. The use of sprinklers adds a measure of safety by allowing more time for residents to vacate the building.

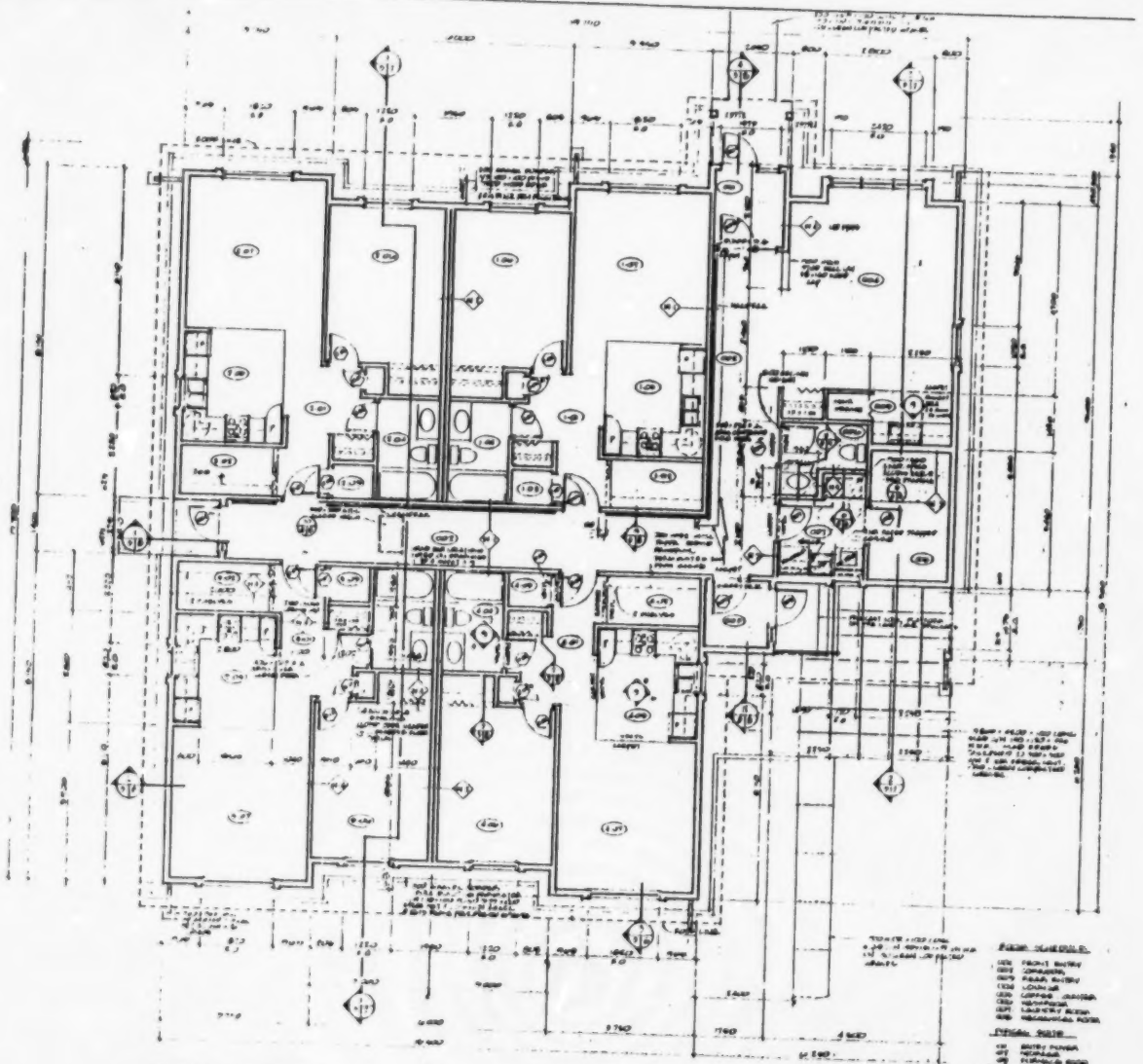
Insurance costs were also reviewed; however, since the buildings analyzed are covered by a government insurance program, no cost savings are available for these projects. There may, however, be some costs savings available for private buildings of this type. The Insurer's Advisory Group (IAG) noted that they generally recommend a 10 to 30% reduction in premiums for sprinklered buildings. They point out, however, that the premiums are market-driven, and as a result, actual reductions offered may be in the order of 10%.

In summary, it was concluded that residential sprinklers may add a measure of increased fire safety to any multi-unit, low-rise, wood-framed residential building, but sprinkler systems cannot be justified in terms of savings from reduced construction costs.

APPENDIX A

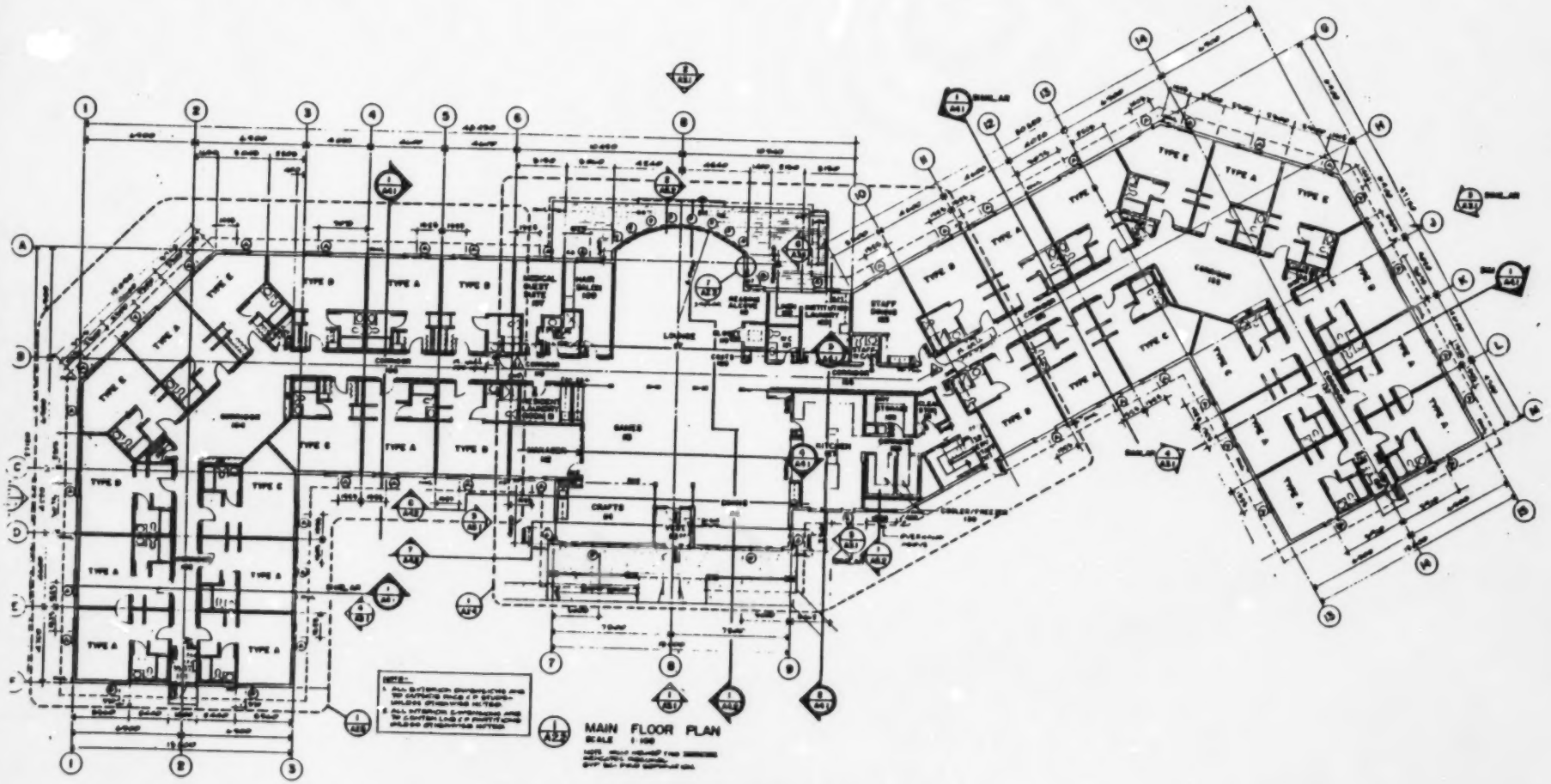
FLOOR PLANS OF TYPICAL BUILDINGS

Type 1	Senior Citizens' Apartment - 4 Unit Single Storey
Type 2	Senior Citizens' Lodge - 30 Unit Single Storey
Type 3	Senior Citizens' Apartment - 33 Unit Three Storey

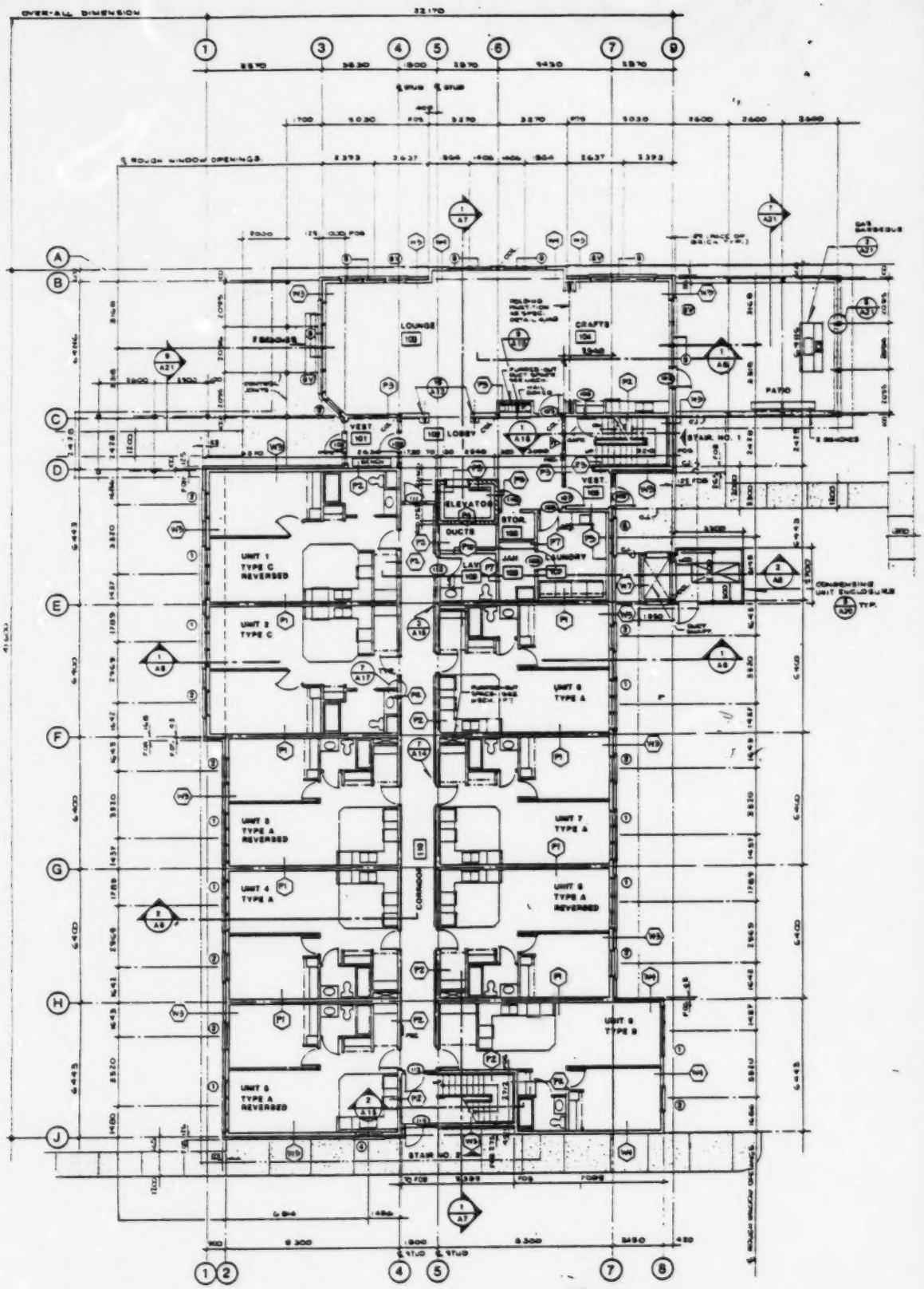


1 MAIN FLOOR PLAN

TYPE 1 SENIOR CITIZENS APARTMENTS



TYPE 2 SENIOR CITIZENS LODGE



SCALE PLANS A13 AND A14
IN DIMENSIONS OF
ES ELEVATOR AND SERVICE
AND RECREATION AREAS.

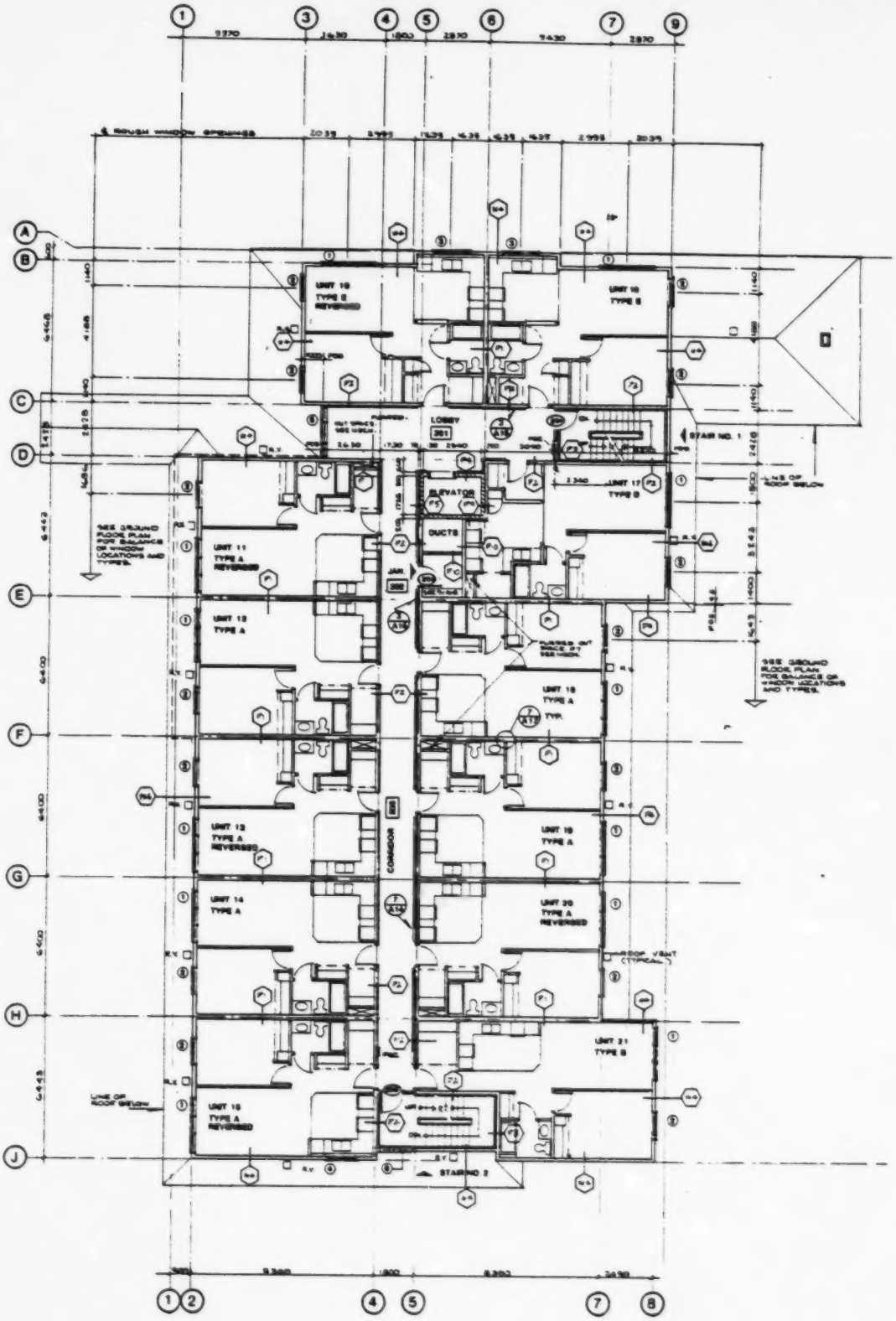
① — WINDOW TYPES SEE DRAWING NO. A11

NOTE:
ALL GRID LINE DIMENSIONS ARE TO FACE OF STUD OR CENTRE OF PARTY WALL UNLESS NOTED OTHERWISE.
FOS - FACE OF STUD
FOB - FACE OF BRICK

GROUND FLOOR PLAN

SCALE 1 : 100

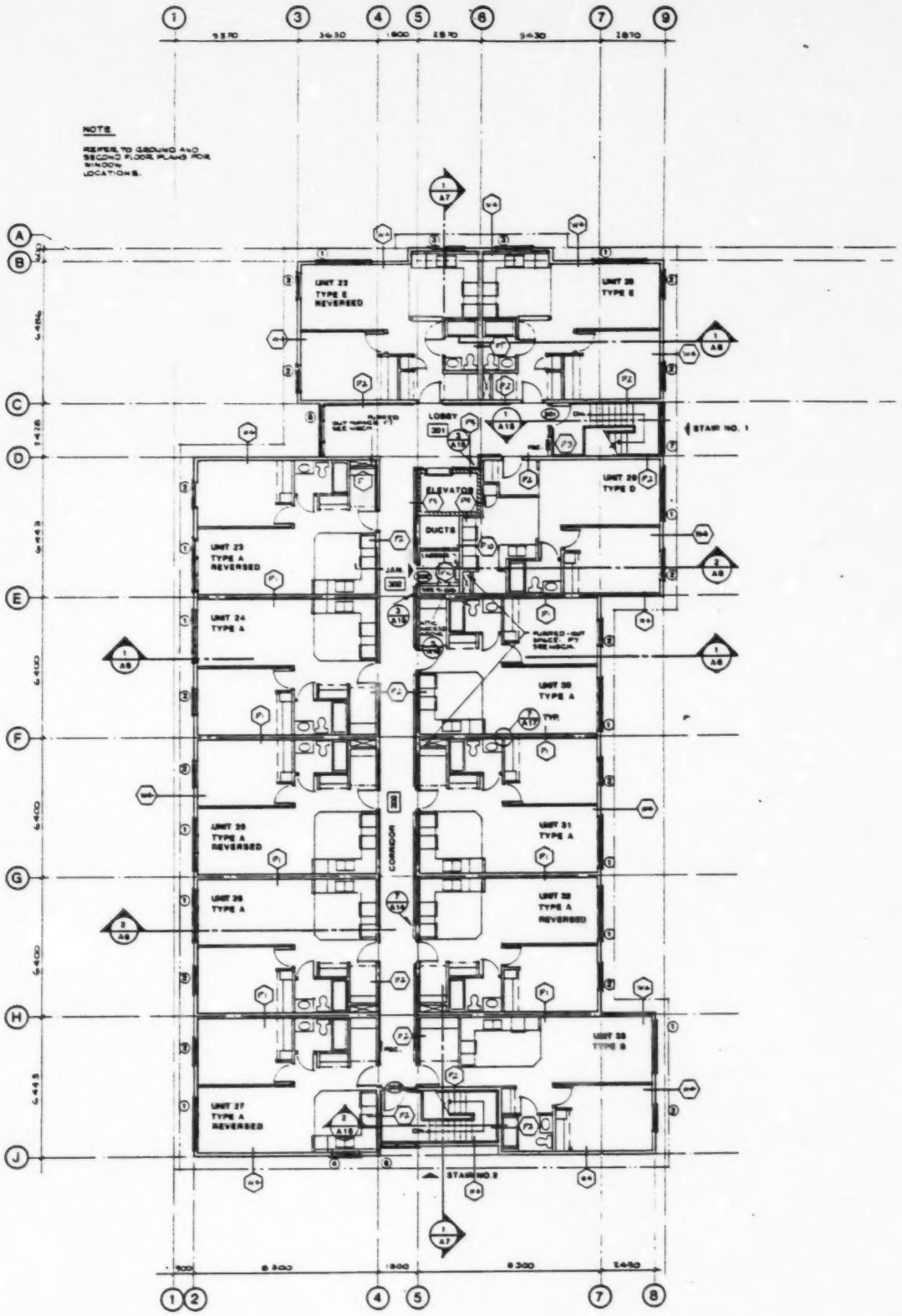
TYPE 3 SENIOR CITIZENS APARTMENT


UNIT 10 TYPE E REVERSED
UNIT 16 TYPE E
LOBBY
ELEVATOR
DUCTS
UNIT 17 TYPE D
UNIT 11 TYPE A REVERSED
UNIT 12 TYPE A
UNIT 18 TYPE A TYP.
CORRIDOR
UNIT 13 TYPE A REVERSED
UNIT 19 TYPE A
UNIT 14 TYPE A
UNIT 20 TYPE A REVERSED
UNIT 21 TYPE B
UNIT 15 TYPE A REVERSED
STAIR NO. 1
STAIR NO. 2
SEE GROUND FLOOR PLAN FOR BALANCE OF WINDOW LOCATIONS AND TYPES.
LINE OF ROOF BELOW

① — WINDOW TYPES SEE DRAWING NO. A11

SECOND FLOOR PLAN SCALE 1 : 100

TYPE 3 **SENIOR CITIZENS APARTMENT**



THIRD FLOOR PLAN

SCALE 1 : 100

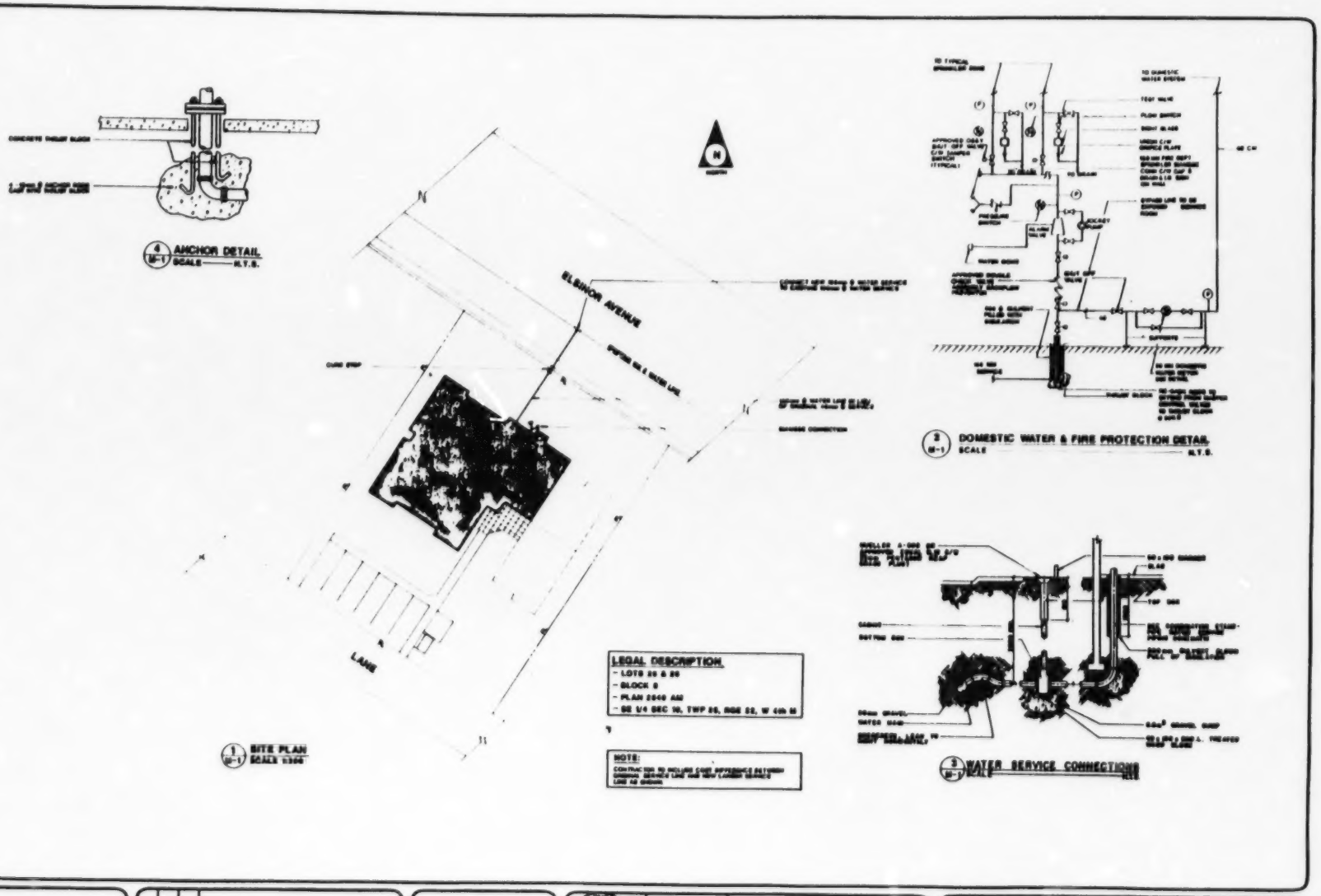
TYPE 3

SENIOR CITIZENS APARTMENT

APPENDIX B

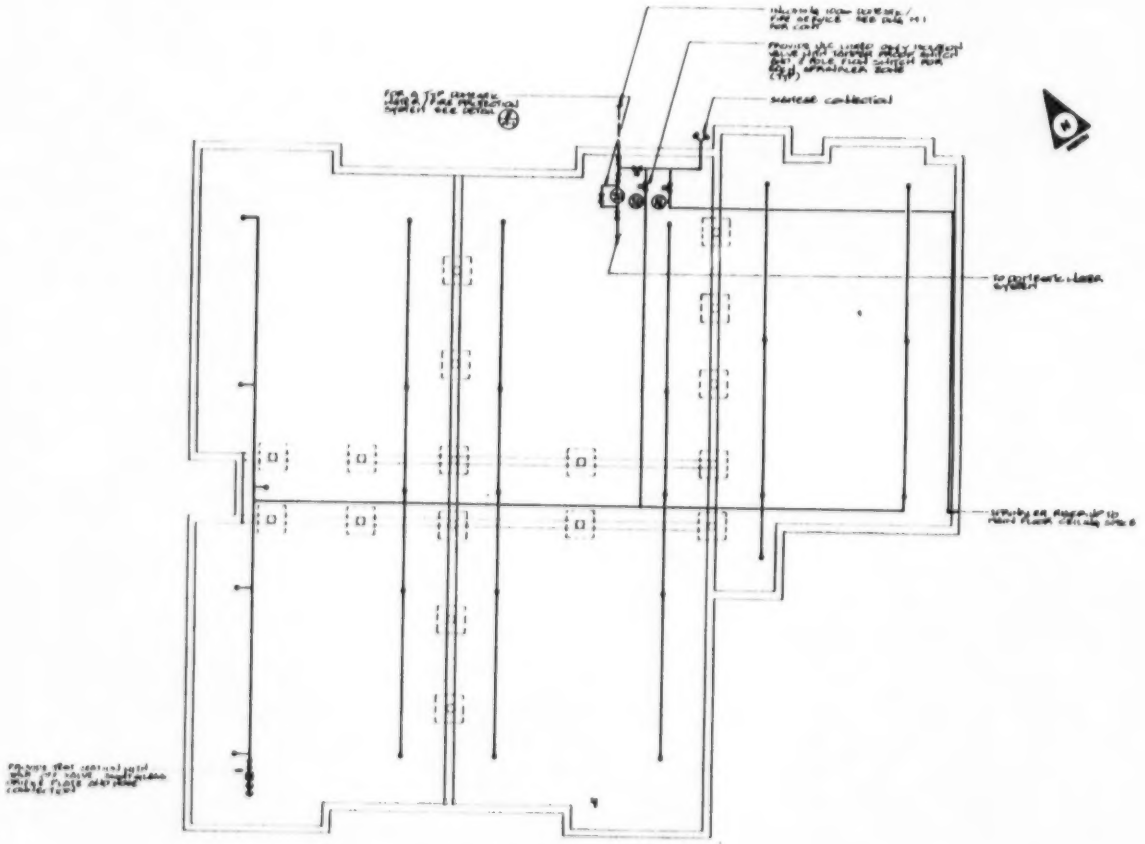
TECHNICAL DRAWINGS OF SPRINKLER SYSTEM

Type 1	Senior Citizens' Apartment - 4 Unit Single Storey
Type 2	Senior Citizens' Lodge - 30 Unit Single Storey
Type 3	Senior Citizens' Apartment - 33 Unit Three Storey



			PERMIT TO PRACTICE	Lundie forest engineering ltd.	SENIOR CITIZENS APARTMENT
					MECHANICAL SITE PLAN
					M-1

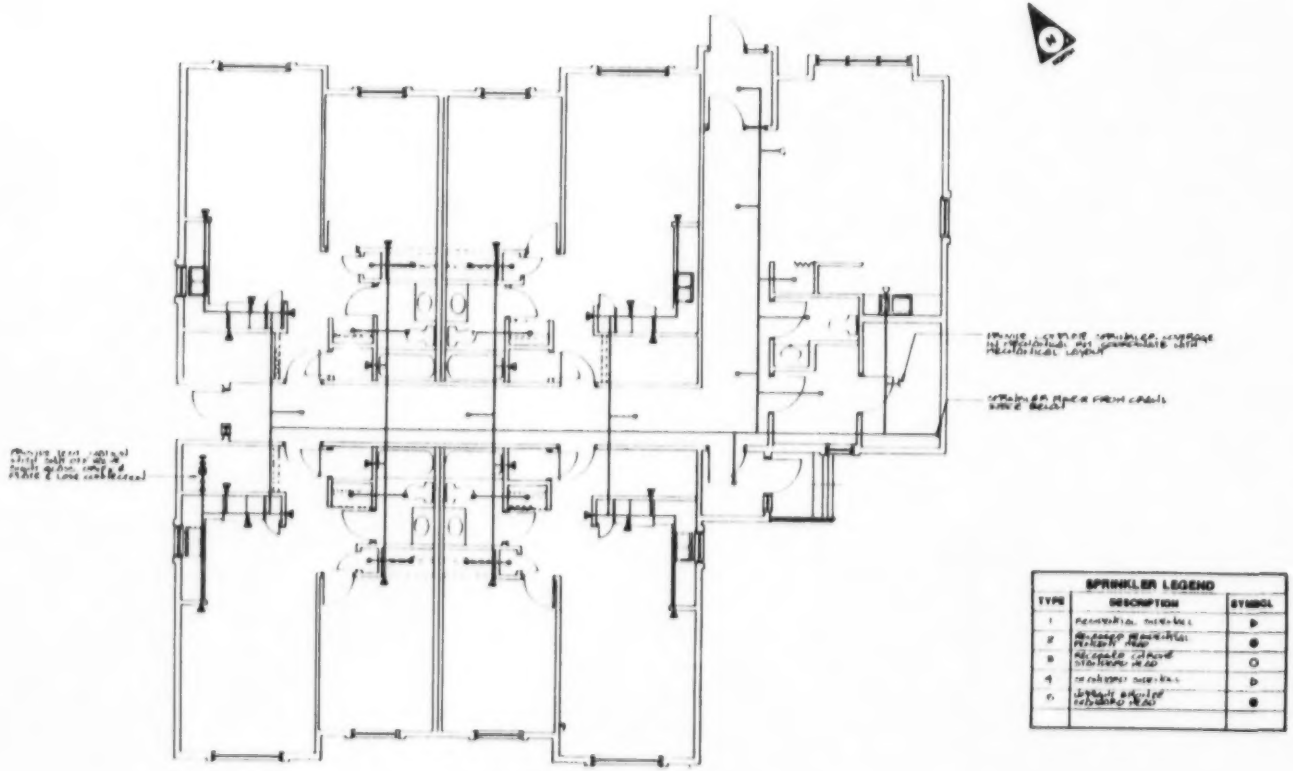
Type 1 - Senior Citizens Apartment - 4 Unit Single Storey



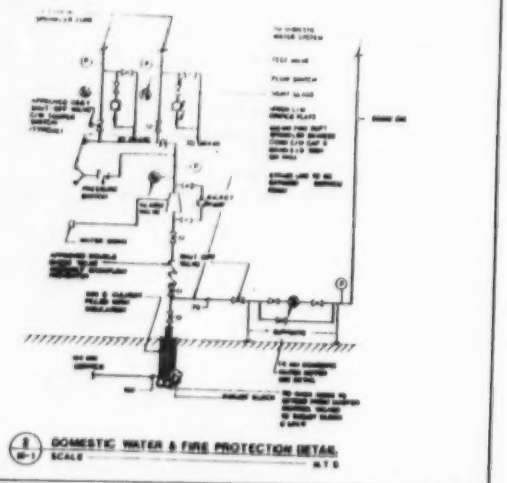
1 CRAWL SPACE - SPRINKLER LAYOUT
SCALE

SENIOR CITIZENS APARTMENT
SPRINKLER SYSTEM LAYOUT
M-2

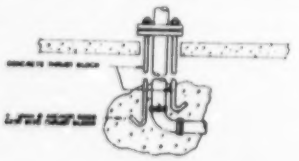
Type 1 - Senior Citizens Lodge - 4 Unit Single Storey



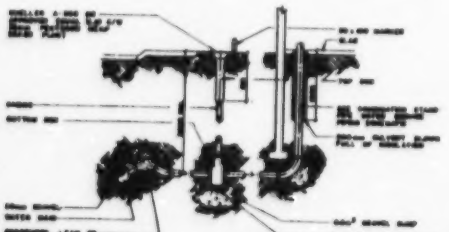
Type 1 - Senior Citizens Apartment - 4 Unit Single Storey



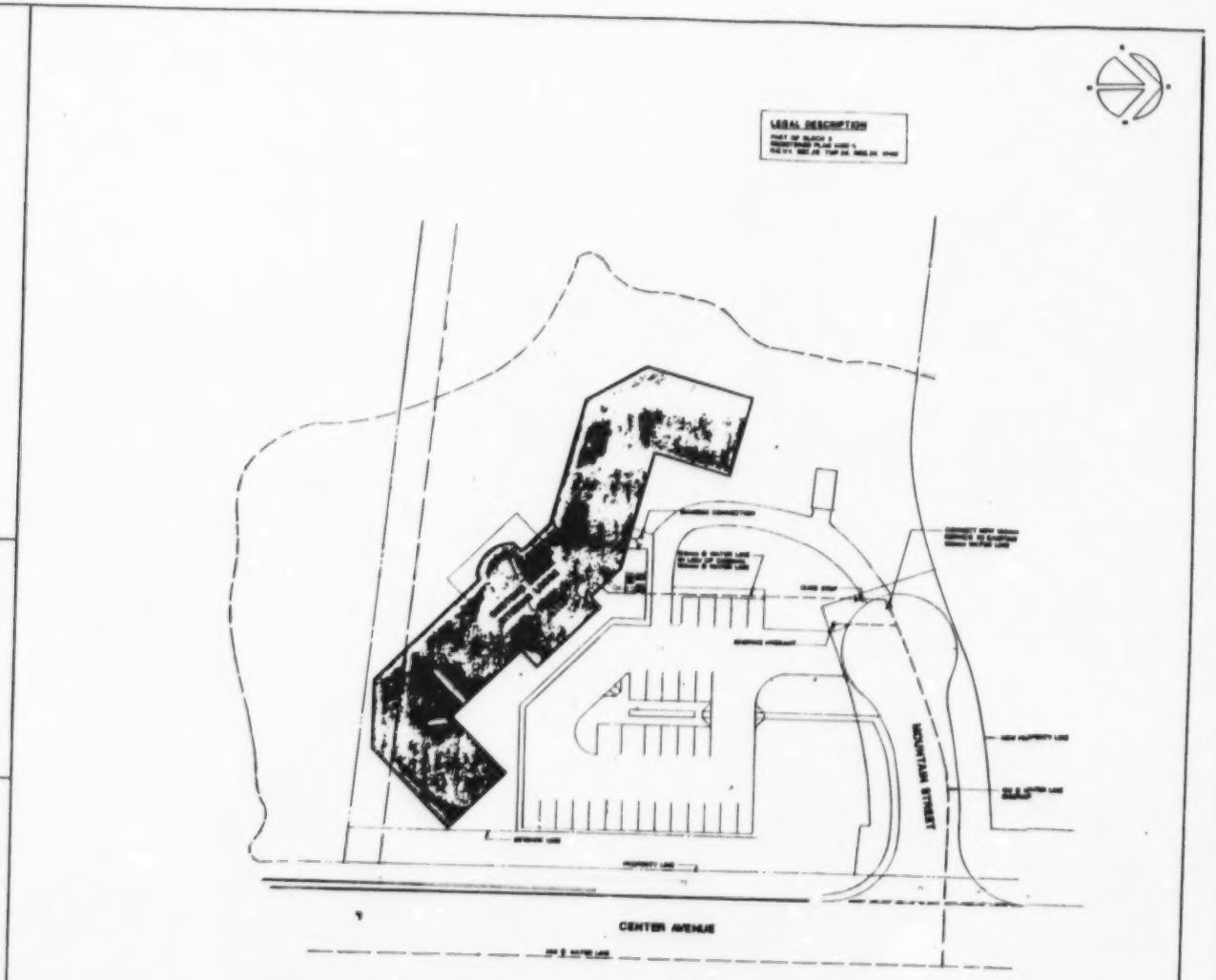
DOMESTIC WATER & FIRE PROTECTION DETAIL
SCALE — N.T.S.



ANCHOR DETAIL
SCALE — N.T.S.



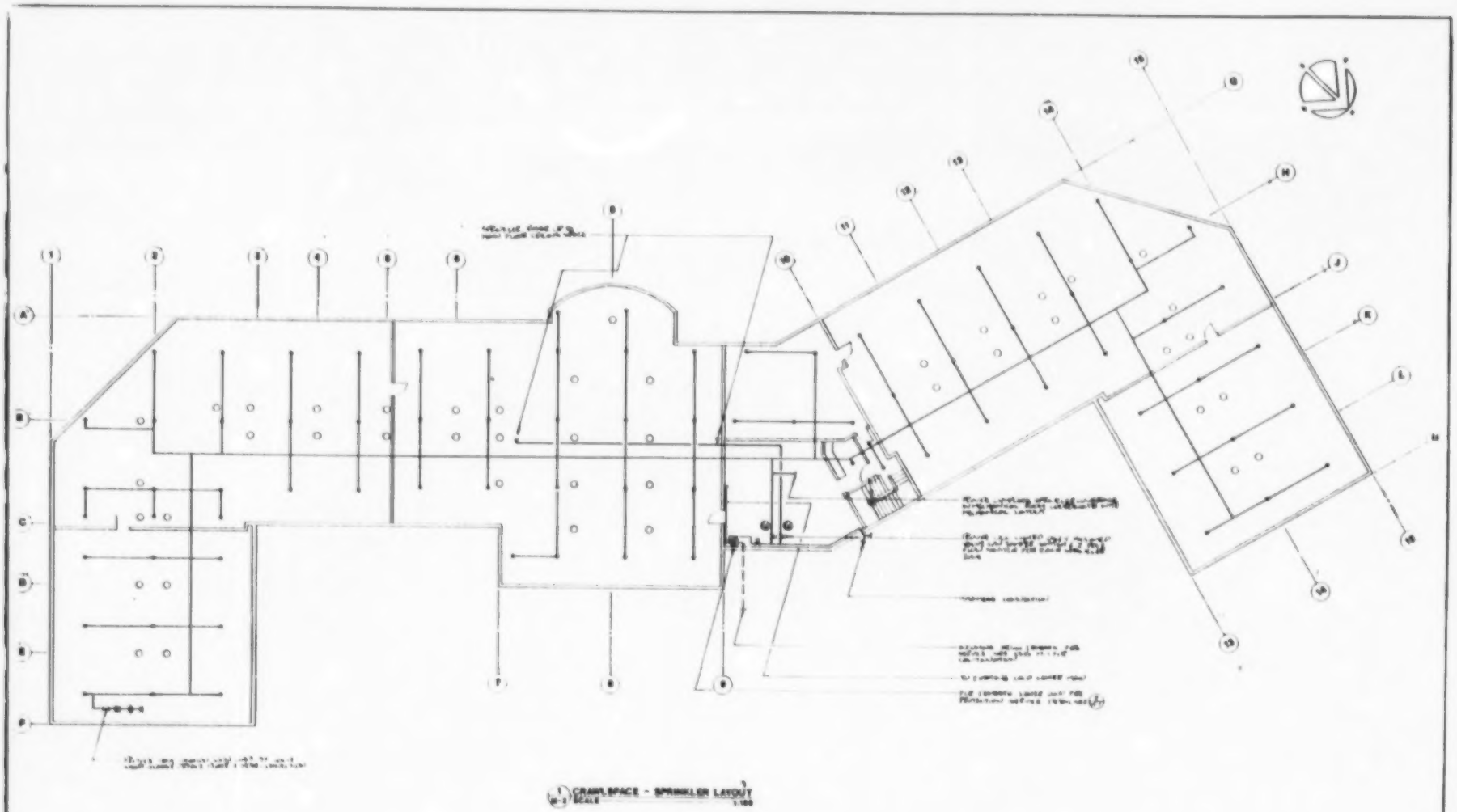
WATER SERVICE CONNECTIONS



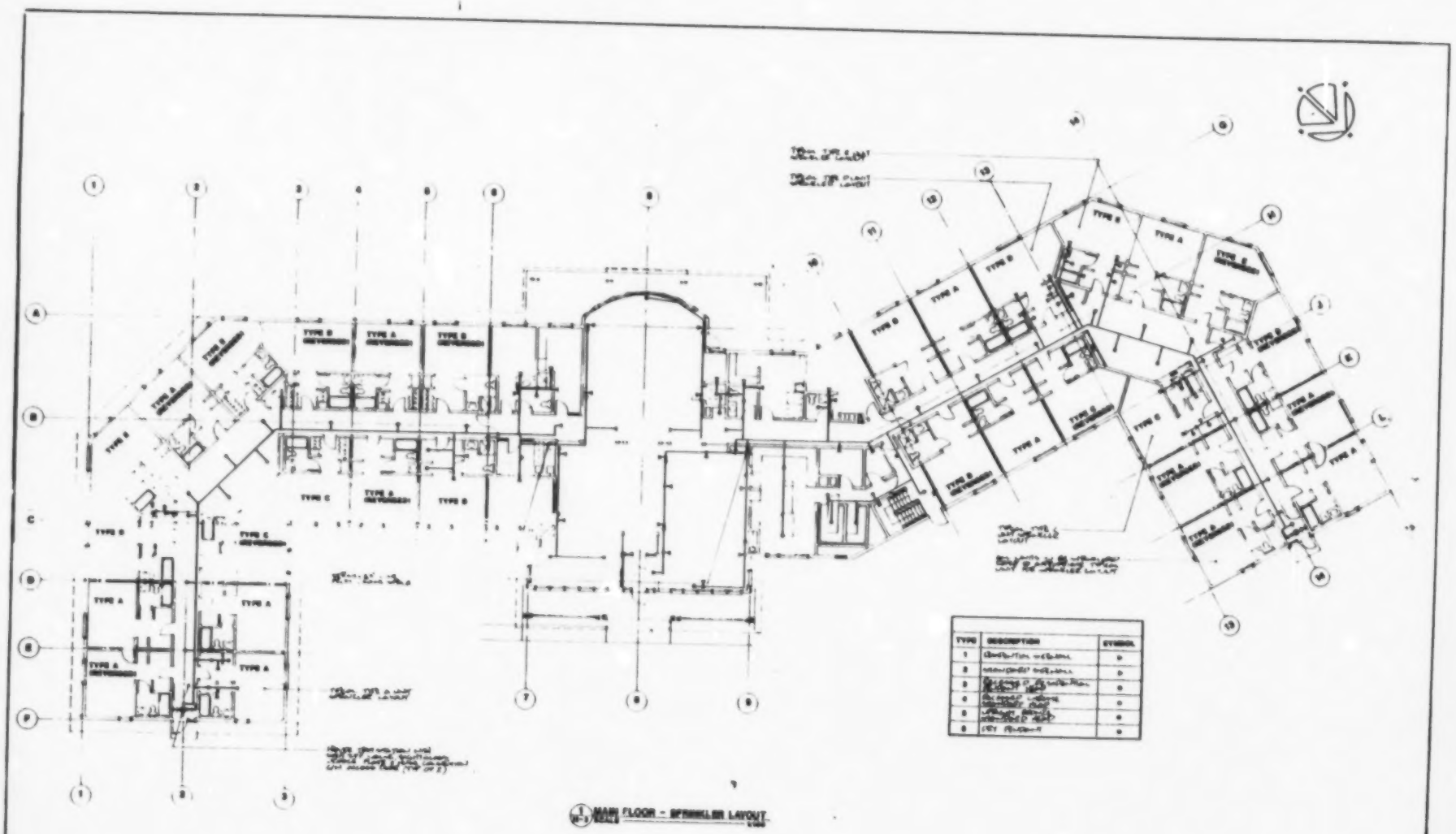
MECHANICAL SITE PLAN
SCALE — 1:200

NOTE:

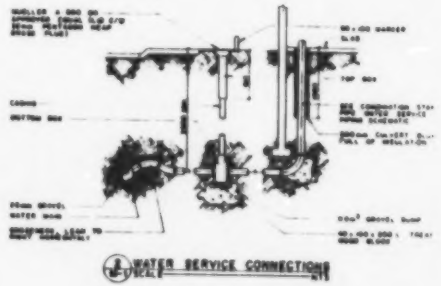
Type 2 - Senior Citizens Lodge - 30 Unit Single Storey



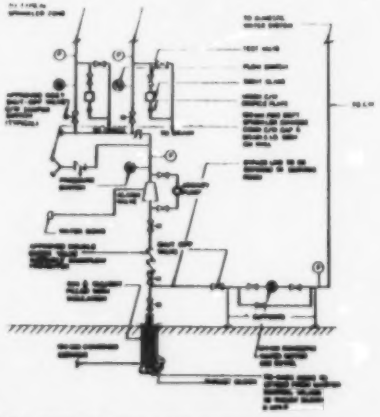
Type 2 - Senior Citizens Lodge - 30 Unit Single Storey



Type 2 - Senior Citizens Lodge - 30 Unit Single Sto...

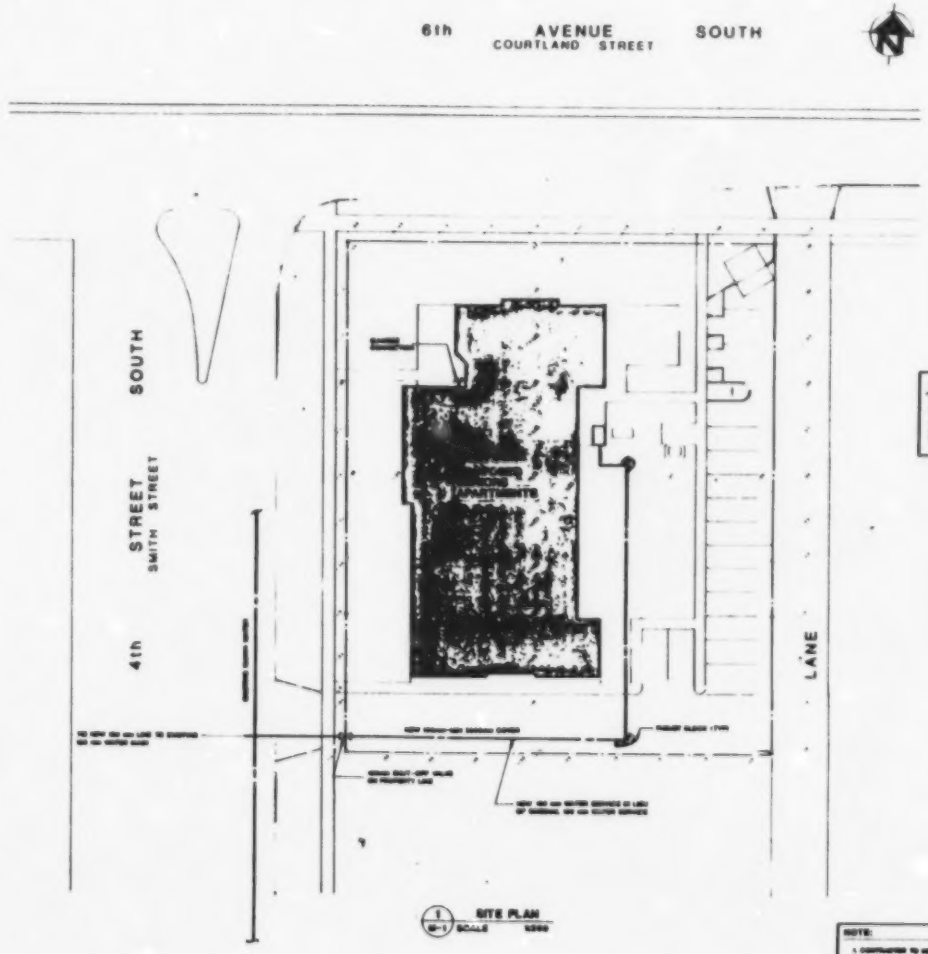


WATER SERVICE CONNECTION



DOMESTIC WATER & FIRE PROTECTION DETAIL

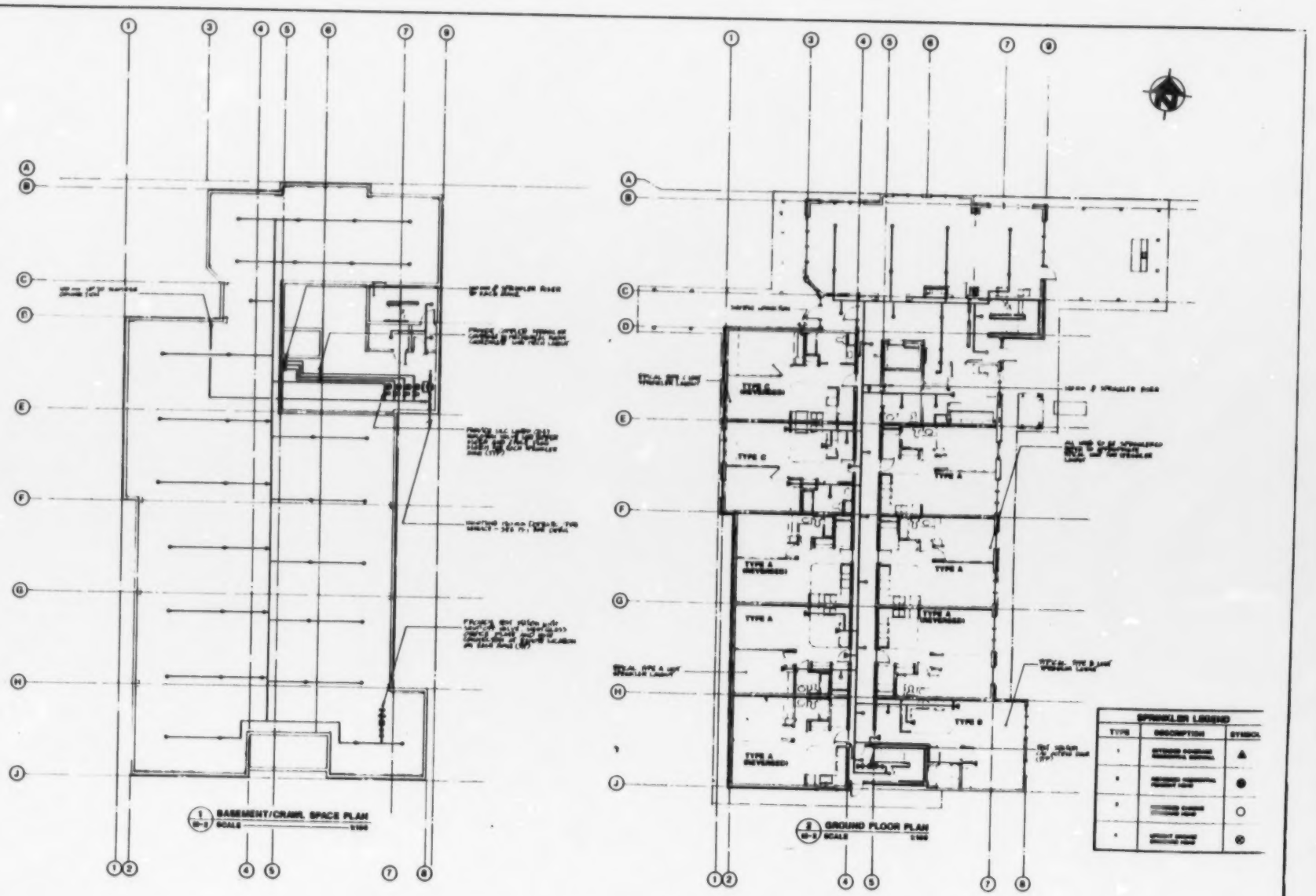
ANCHOR DETAIL



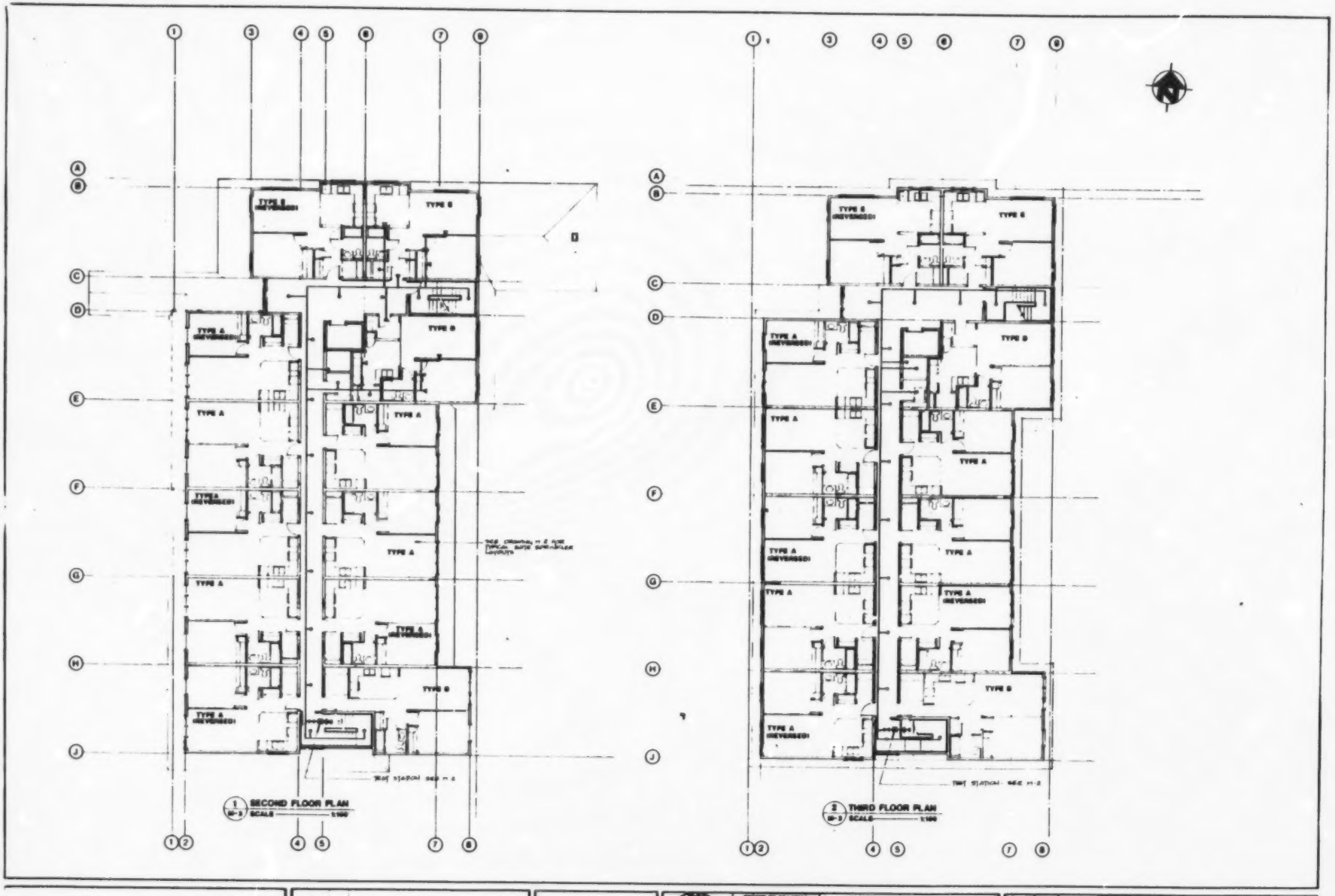
SITE PLAN

				LETHBRIDGE YWCA SENIOR CITIZENS APARTMENTS	
				MECHANICAL SITE PLAN	M-1

Type 3 - Senior Citizens Apartment - 33 Unit Three Storey



Type 3 - Senior Citizens Apartment - 33 Unit Three Storey



LETHBRIDGE VIII SENIOR CITIZENS APARTMENTS

SPRINKLER SYSTEM LAYOUT

M-3

Type 3 - Senior Citizens Apartment - 33 Unit Three Storey

APPENDIX C

SPECIFICATION FOR SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 Related Requirements

.1 General Requirements: Section 01001.

1.2 Reference Standards

.1 Do work in accordance with the following except where specified otherwise.
  .1 Alberta Building Code (1985).
  .2 NFPA 13R.

1.3 Certificates

.1 Provide certification at the completion of the project that the sprinkler system is installed in compliance with applicable reference standards including the Alberta Building Code.

1.4 Engineering Design Criteria

.1 Design system to NFPA 13R using following parameters:
  .1 Hazard:
    .1 Residential - NFPA 13R.
  .2 Pipe size and layout:
    .1 Hydraulic design for sprinkler system.
    .2 Head layout: to NFPA 13R as indicated.
  .3 Water supply:
    .1 For the purposes of tendering only, base design on NFPA 13R.
  .4 Zoning:
    .1 System zoning as indicated.

1.5 Maintenance Data

.1 Provide maintenance information specified in Section 01001 - General Requirements.

1.6 Maintenance Materials

.1 Provide spare sprinklers and tools as required by NFPA 13R in cabinet in furance room.

PART 2 - PRODUCTS

2.1 Pipe, Fittings and Valves

.1 Pipe:
- .1 Ferrous: to NFPA 13R.
- .2 Copper tube: to NFPA 13R.
- .3 Plastic to ULC C199P.

.2 Fittings and joints:
- .1 Screwed, soldered, to NFPA 13R.

.3 Valves:
- .1 ULC listed for fire protection service.
- .2 Bronze to NPS 2.
- .3 Threaded to NPS 2.
- .4 For shut off service: OS & Y gate.
- .5 Swing check soft seated valves.

.4 Pipe hangers:
- .1 To NFPA Standard.

2.2 Sprinkler Heads

.1 General: to NFPA 13R and ULC listed for Residential Quick Response fire service.

.2 Type to be as indicated.

2.3 Supervisory Switches

.1 Flow Switch:
- .1 With N.O. and N.C contacts and supervisory capability.
- .2 With adjustable time delay.

2.4 Alarm Bell

.1 To NFPA 13 and ULC-S525-1978: surface mounted, vibrating under dome, steel alloy bell, 150 mm diameter, 120 vac, 92 dB output at 3 m on

2.5 Signs

.1 Signs for control, drain and test valves: to NFPA 13R.

PART 3 - EXECUTION

3.1 Installation

.1 Install and test to acceptance in accordance with NFPA 13R.

.2 Install pressure booster pump and storage tank in accordance with manufacturer's instructions and as indicated for rural and private water system installations.

.3 Testing to be witnessed by authorities having jurisdiction.

END